

AMENDMENTS TO THE SPECIFICATION AND ABSTRACT

In the specification, page 1, last paragraph, please amend the paragraph as follows:

As shown in FIG. 20, inside a combustor main body 1, a pilot nozzle 2 is inserted into the center thereof;~~and at~~ At the same time, main nozzles 3 are inserted so as to be located around the pilot nozzle 2. Then, a pilot cone 4 is installed so as to cover the tip portion of the pilot nozzle 2. Additionally, main burners 5 are installed so as to cover the tip portions of the main nozzles 3. Moreover, pilot swirls 6 are installed around the tip portion of the pilot nozzle 2, and main swirls 7 are installed around the tip portions of the main nozzles 3, so that the pilot nozzle 2 and the main nozzles 3 will be supported.

In the specification, page 2, second paragraph, please amend the paragraph as follows:

In a combustor being constructed as mentioned hereinabove, the surrounding area of the tip portion of the pilot nozzle 2 is constructed as shown in FIG. 21. The outer circumference of the tip of the pilot nozzle 2 has a plurality of fuel injection ports 21 installed so as to diffuse and inject the fuel. {The fuel which is to be injected by the pilot nozzle 2 will be referred as “pilot fuel” hereinafter.} Additionally, the air which is to be supplied to the surrounding area of the pilot nozzle 2 by way of the combustor main body 1 (“pilot air”) flows along the inner wall of the pilot cone 4 after passing through the pilot swirls 6. As a result, the pilot fuel being diffused and injected by the pilot nozzle 2 burns, forming diffusion flame (F); and furthermore, a part of the pilot fuel burns and at the same time, high temperature combustion gas from the pilot diffusion flame enters, forming a low-speed flame-stabilizing zone “X” which serves as a flame stabilizing point for the main premixed flame, thereby maintaining combustion.

In the specification, page 2, last paragraph, please amend the paragraph as follows:

Additionally, the fuel being injected from the main nozzles 3 (“main fuel”) flows into the main burners 5 together with the air (“main air”), passing through the main swirls 7 and is mixed inside the main burners 5, thereby letting the main fuel and the main air being mixed by the main burners 5 flow out. When an air-fuel pre-mixture which is a mixture of the main air and the main fuel flows out from the main burners 5, the air-fuel pre-mixture is burned toward the inner wall of the combustor main body 1 from the downstream-side tips of the main burners 5, based on combustion in the low-speed flame-stabilizing zone “X.” (Herein, “downstream” means the downstream of the fuel and the air flows.)

In the specification, page 4, first paragraph, please amend the paragraph as follows:

Additionally, stability of combustion can be achieved by forming a low-speed flame-stabilizing zone “X” as shown in FIG. 22. However, in order to promote reduction in NO_x further, it is necessary to decrease pilot diffusion flame, but the current low-speed flame-stabilizing zone “X” is not large enough. In addition, because the downstream-side tip of the pilot cone 4f is formed so as to project toward the main burners 5, a stagnant area “Y” where the air-fuel pre-mixture flowing from the main burners 5 forms vortex is formed in the portion at the outlets of the main burners 5 where the pilot cone 4f projects. There is a concern that formation of a stagnant area “Y” might lead to generation of flashback.

In the specification, page 4, third paragraph, please amend the paragraph as follows:

In order to achieve the above-mentioned objects, a combustor in accordance with the present invention is characterized by including: a pilot nozzle which is installed in the center portion of the combustor main body; a plurality of main nozzles which are installed around the circumference of the pilot nozzle, being equally spaced; a pilot cone which covers the downstream-side tip portion where the fuel of the pilot nozzle flows and which has the tip portion thereof provided with a tapered portion of the inner circumference of a cone that is shaped to be tapered in a radial pattern toward the downstream side; and pilot swirls which are installed so as to be in contact with the inner wall surface of the pilot cone and to support the pilot nozzle in the center portion of the pilot cone; ~~and is characterized by having wherein the fuel is being injected therein~~ from the fuel injection ports being provided to the outer circumference of the pilot nozzle tip to inject the fuel bump against the inner wall surface of the tapered portion of the inner circumference of a cone from the position being half as long as the tapered portion of the inner circumference of a cone to the downstream-side tip.

In the specification, page 5, second paragraph, please amend the paragraph as follows:

Additionally, the combustor in accordance with the present invention is characterized by including: a pilot nozzle which is installed in the center portion of the combustor main body; a plurality of main nozzles which are installed around the circumference of the pilot nozzle, being equally spaced; a pilot cone which covers the downstream-side tip portion where the fuel of the pilot nozzle flows and which has the tip portion thereof provided with a tapered portion of the inner circumference of a cone that is shaped to be tapered in a radial pattern toward the downstream side; and pilot swirls which are installed so as to be in contact with the inner wall surface of the pilot cone and to support the pilot nozzle in the center portion of the pilot cone; and is characterized by that

when the opening angle of the pilot cone is " θ ," the injection angle of the fuel being injected from the fuel injection ports being provided to the outer circumference of the tip of the pilot nozzle so as to inject the fuel is " $\theta/2$," wherein, the fuel is injected in parallel with the inclination of the tapered portion of the inner circumference of a cone.

In the specification, page 5, last paragraph, please amend the paragraph as follows:

Moreover, the combustor in accordance with the present invention is characterized by including: a pilot nozzle which is installed in the center portion of the combustor main body; a plurality of main nozzles which are installed around the circumference of the pilot nozzle, being equally spaced; a pilot cone which covers the downstream-side tip portion where the fuel of the pilot nozzle flows; and pilot swirls which are installed so as to be in contact with the inner wall surface of the pilot cone and to support the pilot nozzle in the center portion of the pilot cone;~~;~~ ~~and~~ The combustor is characterized by including: a first fuel supply channel having a large part of the fuel being installed in the center portion of the pilot nozzle and being supplied to the pilot nozzle pass through; a second fuel supply channel being installed around the first fuel supply channel and having the remaining fuel being supplied to the pilot nozzle pass through; a cylindrical pilot nozzle cover whose outer wall surface is in contact with the inner wall surface of the pilot swirls, covering the downstream-side tip of the pilot nozzle and leading the air passing through the outer circumference of the pilot nozzle to the downstream-side tip of the pilot nozzle; a first fuel injection pipe being installed to the outer circumference of the downstream-side tip of the pilot nozzle, penetrating through the pilot nozzle cover from the first fuel supply channel and injecting the fuel being supplied from the first fuel supply channel to the outer circumference of the pilot nozzle cover; and fuel

injection ports being provided to the upstream side to the first fuel injection pipe on the outer circumference of the pilot nozzle, being connected to the second fuel supply channel, and injecting the fuel being supplied from the second fuel supply channel to the region, consisting of the pilot nozzle cover and the pilot nozzle.

In the specification, page 6, last paragraph, please amend the paragraph as follows:

In addition, the combustor in accordance with the present invention is characterized by including: a pilot nozzle which is installed in the center portion of the combustor main body; a plurality of main nozzles which are installed around the circumference of the pilot nozzle, being equally spaced; a pilot cone which covers the downstream-side tip portion where the fuel of the pilot nozzle flows; ~~and~~ pilot swirls which are installed so as to be in contact with the inner wall surface of the pilot cone and to support the pilot nozzle in the center portion of the pilot cone; and as well as by ~~having~~ a cylinder which is in contact with the downstream-side surfaces of the pilot swirls and comes close to the outer wall surface of the pilot nozzle ~~being~~ being located downstream side to the pilot swirls and has a tip portion thereof equipped with a collar being tapered so as to be formed in a radial pattern toward the downstream side.

In the specification, page 7, second paragraph, please amend the paragraph as follows:

Furthermore, the combustor in accordance with the present invention is characterized by including: a pilot puzzle which is installed in the center portion of the combustor main body; and a bypass pipe which is connected to a bypass valve bypassing the air being not used for combustion to the downstream side of the combustor and which is installed to the upper side of the combustor main body;~~;~~~~wherein~~ Wherein, the pilot nozzle has a plurality of fuel injection ports which is installed at the positions excluding the nearest position to the bypass pipe in order to inject the fuel being supplied to the pilot nozzle and which is installed to the outer circumference of the downstream-side tip thereof.

In the specification, page 7, last paragraph, please amend the paragraph as follows:

Additionally, the combustor in accordance with the present invention is characterized by including: a pilot puzzle which is installed in the center portion of the combustor main body; and a connection pipe which is installed to the side surface of the combustor main body, propagating the flame to another combustor;~~;~~~~wherein~~ Wherein, the pilot nozzle has a plurality of fuel injection ports which is installed at the positions excluding the nearest position to the connection pipe in order to inject the fuel being supplied to the pilot nozzle which is installed to the outer circumference of the downstream-side tip thereof.

In the specification, page 8, first paragraph, please amend the paragraph as follows:

Also, the combustor in accordance with the present invention is characterized by including: a pilot puzzle which is installed in the center portion of the combustor main body; and a bypass pipe which is connected to a bypass valve bypassing the air being not used for combustion to the downstream side of the combustor and which is installed to the upper side of the combustor main body;~~;~~ ~~wherein~~ Wherein, the bypass valve is slightly opened in the state of combustion.

In the specification, page 8, second paragraph, please amend the paragraph as follows:

Additionally, the combustor in accordance with the present invention is characterized by including: a pilot puzzle which is installed in the center portion of the combustor main body; a plurality of main nozzles which are installed around the circumference of the pilot nozzle, being equally spaced; a pilot cone which covers the downstream-side tip portion where the fuel of the pilot nozzle flows; and main burners which cover the downstream-side tips of the main nozzles;~~;~~ ~~wherein~~ Wherein, the pilot cone comprises: a tapered portion of inner circumference of a cone being formed in a tapered shape so as to stretch out in a radial pattern toward a downstream side; and a collar portion which is provided to an external periphery of a downstream-side tip of the tapered portion of inner circumference of a cone and serves as a surface being approximately vertical to axial direction of the said pilot nozzle;~~;~~ ~~and wherein~~ Wherein, an angle in axial direction to a line connecting an external periphery of a downstream-side tip of the pilot nozzle and an external periphery of downstream-side tips of the main burners is specified as " α_x ," an opening angle of the tapered portion of inner circumference of a cone " θ " is " $0 \leq \theta < 2\alpha_x$."

In the specification, page 8, last paragraph, please amend the paragraph as follows:

Moreover, the combustor in accordance with the present invention is characterized by including: a pilot puzzle which is installed in the center portion of the combustor main body; a plurality of main nozzles which are installed around the circumference of the pilot nozzle, being equally spaced; a pilot cone which covers the downstream-side tip portion where the fuel of the pilot nozzle flows; and main burners which cover the downstream-side tips of the main nozzles; ~~wherein~~
Wherein, the pilot cone comprises: a tapered portion of inner circumference of a cone being provided to downstream-side tip portion and being formed to be tapered, extending in a radial pattern to proximity of downstream-side tips of the main burners, a first cylindrical portion protruding from an external periphery of downstream-side tip of the tapered portion of inner circumference of a cone to centers of the main burners; a second cylindrical portion protruding from an external periphery of downstream-side tip of the tapered portion of inner circumference of a cone to centers of the main burners; and a cylinder being formed so as to be along an outer wall of the tapered portion of inner circumference of a cone and have downstream-side tip thereof be in contact with downstream-side tips of the main burners.

In the specification, page 9, last paragraph, please amend the paragraph as follows:

Furthermore, the combustor in accordance with the present invention is characterized by including: a pilot puzzle which is installed in the center portion of the combustor main body; a plurality of main nozzles which are installed around the circumference of the pilot nozzle, being equally spaced; a pilot cone which covers the downstream-side tip portion where the fuel of the pilot nozzle flows; and main burners which cover the downstream-side tips of the main nozzles; ~~wherein~~

Wherein the pilot cone is installed to the downstream-side tip portion,⁵ and is also characterized by including: a first cylindrical portion which protrudes in the direction of the center of the main burners from the tapered portion of the inner circumference of the tapered cone spreading in a radial pattern close to the downstream-side tips of the main burners and from the outer edge of the downstream-side tip of the tapered portion of the inner circumference of a cone; a second cylindrical portion which protrudes in the direction of the center of the pilot burner from the outer edge of the downstream-side tip of the tapered portion of the inner circumference of a cone; and a cylinder being formed so as to be along the outer wall of the tapered portion of the inner circumference of a cone and having the downstream-side tip thereof get in contact with the downstream-side tips of the main burners.

In the specification, page 12, in the title preceding the fourth paragraph, please amend the paragraph as follows:

~~Best Mode for Carrying Out Detailed Description of the Invention~~

Referring now to the drawings, a combustor of the present invention will be described hereinafter. In each embodiment to be described hereinafter, outline of the relationship of each of portions constituting a combustor is expressed by a schematic block diagram of FIG. 20 in the same manner as is conventionally done. Therefore, construction of vicinity of a tip of a pilot nozzle which is a characteristic aspect of the present invention will be described in details hereinafter.

In the specification, page 12, last paragraph, please amend the paragraph as follows:

A combustor of FIG. 1 has a pilot nozzle 2, having downstream-side tip thereof covered by a pilot cone 4, installed to the center portion of a combustor main body 1 (FIG. 20) and has a plurality of main nozzles 3, having downstream-side tips thereof covered by main burners 5, installed around the pilot nozzle 2. Then, by having pilot swirls 6 installed to the downstream-side outer wall surface of the pilot nozzle 2, the pilot nozzle 2 is supported so as to be placed in the center portion of a pilot cone 4. Additionally, by having main swirls 7 installed to the downstream-side outer wall surface of the main nozzle 3, the main nozzle 3 is supported so as to be placed in the center of the main burners 5.

In the specification, page 13, second paragraph, please amend the paragraph as follows:

Constructed as mentioned hereinabove, the pilot cone 4 is formed so as to be tapered, spreading in a radial pattern toward the downstream-side tip thereof. (The portion which spreads in a radial pattern will be referred as a “tapered portion of the inner circumference of a cone” hereinafter.) By having the tapered portion of the inner circumference of a cone 41 shaped so as to spread in a radial pattern, the pilot fuel being injected from the fuel injection ports 21 being installed to the outer circumference of the tip of the pilot nozzle 2 and the pilot air flowing through the pilot swirls 6 are introduced to a low-speed flame-stabilizing zone “X” ~~serveing~~serving as the periphery of the tapered portion of the inner circumference of a cone 41, being located in the proximity of the downstream-side tips of the main burners 5.

In the specification, page 29, last paragraph, please amend the paragraph as follows:

By forming the pilot cone 41 so as to spread in a radial pattern as described hereinabove, the pilot fuel being injected from the fuel injection ports 21 which are provided to the outer circumference of the tip of the pilot nozzle 2 is diffused and burned by the pilot air passing through the pilot swirls 6 and introduced to the downstream-side tips of the main burners 5. Then, the pilot diffusion flame is led to the flame-stabilizing low-speed zone “X” being formed on the downstream side of the collar 42 of the tapered portion of the inner circumference of a cone 41, along the inner wall of the tapered portion of the inner circumference of a cone 41. The flame-stabilizing low-speed zone “X” is sized in accordance with the width ~~“1x”~~ “1” of the collar 42 of the tapered portion of the inner circumference of a cone 41.

In the specification, page 30, second paragraph, please amend the paragraph as follows:

Moreover, in flowing into the space between the tapered portion of the inner circumference of a cone 41 and the cylinder ~~32~~43, the air passing through the outer circumference of the pilot cone 4a flows out to the downstream-side tips of the main burners 5, passing through the space between the collar 42 and the collar 44, and flows into the portion serving as the boundary between the main burners 5 and the pilot cone 4a, being in a form of film. By flowing the air in film to the boundary in the above-mentioned manner, flashback being caused by the flame in the flame-stabilizing low-speed zone “X” can be prevented. Additionally, because the air passes through the space between the tapered portion of the inner circumference of a cone 41 and the cylinder 43, the tapered portion of the inner circumference of a cone 41 and the collar 42 can be cooled.

In the specification, page 30, penultimate paragraph, please amend the paragraph as follows:

By having the flame-stabilizing low-speed zone “X” formed by the collar 42 of the tapered portion of the inner circumference of a cone 41, where the angle being formed by the line connecting the periphery of the downstream-side tip of the pilot nozzle 2 to the periphery of the downstream-side tips of the main burners 5 at the nearest point thereof and the axial direction of the pilot nozzle 2 is “ α_x ,” the opening angle “ θ ” of the tapered portion of the inner circumference of the main cone 41 is specified to be “ $0^\circ \leq \theta < 2\alpha_x$.” “ $0^\circ < \theta < 2\alpha_x$.” Wherein, it is preferable that the opening angle “ θ ” is 60° or less, and more preferable, narrower than the angle of “ $37^\circ \pm 3^\circ$.”

In the specification, page 30, last paragraph, please amend the paragraph as follows:

In consequence, because the width “~~1x~~” “1” of the collar 42 being formed inside the area connecting the main burners 5 respectively can be sufficiently wide and the area thereof can be made sufficiently large, the size of the flame-stabilizing low-speed zone “X” being formed on the downstream side of the collar 42 can be made sufficiently large, thereby enhancing the flame stability. Additionally, because the collar 42 does not protrude from the downstream-side tips of the main burners 5, no stagnant areas are formed at the downstream-side tips of the main burners 5, thereby preventing flashback from occurring.

In the specification, page 40, second paragraph, please amend the paragraph as follows:

In a combustor being constructed as described hereinabove, as shown in FIG. 18, a pilot cone

4a having a same shape as the ninth embodiment (FIG. 11) is used. ~~Hereat,~~Here, in order to supply a fuel from flame-stability-enhancing fuel supply channels 8 to a low-speed flame-stabilizing zone “X” being formed in the neighborhood of the collar 42, flame-stability-enhancing fuel supply channels 8 are provided so as to penetrate through the collars 42 and 44, and the collar 42 is provided with a flame-stability-enhancing fuel injection port 81. Moreover, because the flame-stability-enhancing fuel supply channels 8 are installed so as to be on the line connecting the center of the pilot nozzle and the centers of the main nozzles, when there are eight main nozzles 3, for example, as shown in FIG. 19, eight flame-stability-enhancing fuel injection ports 81 are provided to the collar 42 of the pilot cone 4a, corresponding respectively.

In the specification, page 41, second paragraph, please amend the paragraph as follows:

Moreover, the combustors in accordance with the ninth through the fourteenth embodiments may have the vicinity of the pilot nozzle thereof constructed in such a manner as the first through the eight embodiments. ~~Hereat,~~Here, the construction of the vicinity of the pilot nozzle thereof may be constructed so as to have a combination of characteristics that are described in the first through the eight embodiments.

In the specification, page 41, in the title preceding the last paragraph, please amend the paragraph as follows:

Industrial Applicability